Vincent Souveton, PhD in Applied Mathematics

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Employment / Community life / Responsabilities

2024 – present

Postdoctoral researcher, French Alternative Energies and Atomic Energy Commission (CEA). Machine learning algorithms for fast computation of blast waves and simulation of complex systems.
– *Research:* probabilistic models, dimension reduction, uncertainty quantification, neural ODEs.
– *Data:* development of codes for downloading public datasets, running Computational Fluid Dynamics simulations on a HPC cluster.
– *Scientific coordination:* creator and organizer of the PhD and postdoctoral researchers' seminar in our lab.

2021 – 2024

PhD student, Université Clermont Auvergne (UCA). Study and development of sampling algorithms for cosmology.
– As part of my PhD, I have been giving tutorials to first-year science students in two different courses.
Mathématiques S2: *asymptotic analysis and Taylor expansion, vector spaces, linear applications, sequences.*
Outils Mathématiques 2: *logic and reasoning, functions of multiple variables, ordinary differential equations.*
– I was elected a PhD student representative at the Doctoral School (May 2022 - November 2023). I have also participated in actions to combat psychosocial hazard, as well as sexist and sexual violence.
– I have been in charge of organizing the PhD and postodctoral researchers' seminar in our lab for two years.

Jan. - June 2021

Master's degree internship, UCA. Interdisciplinary research internship between applied Mathematics and Cosmology. My work consisted in a bibliography search and I produced theoretical results regarding the convexity analysis of a sampling problem. Thesis title: *Mathematical aspects in statistical inference of initial cosmological parameters through forward modeling.*

2020 – 2021

Tutoring, UCA. The job consisted in helping first year science students with their math homework and guide them through efficient preparation for the exams.

July 2018

Volunteer, Archelon. This Greek NGO aims at the protection of sea turtles. I was in charge of patrolling the beaches, raising public awareness, and participating in the daily life of our international camp based in Matala (Crete).

Education

2021 – 2024

PhD, Applied Mathematics, UCA. The goal of my research was to study and develop algorithms to extract meaningful information from astronomical surveys for characterizing the large scale structure of the Universe. I explored both Machine Learning techniques and non-reversible Monte Carlo methods.
Thesis title: *Non-reversible and generative sampling algorithms. Application to the inference of cosmological parameters.*

Education (continued)

2019 – 2021 **MSc, Mathematics, UCA.** Various courses in both fundamental and applied Mathematics. Specialization in Partial Differential Equations during the last year.
1st year thesis title: *Holomorphic functions on the disk and Aleksandrov-Clark measures.*
2nd year thesis title: *Mathematical aspects in statistical inference of initial cosmological parameters through forward modeling.*

2017 – 2018 **Ensai Rennes.** National school for Statistics and data analysis. I chose to leave after one year and a half to focus on a research-oriented education in both fundamental and applied Mathematics.

2015 – 2017 **Classes préparatoires MPSI/MP*, Lycée Blaise Pascal, Clermont-Fd.** Preparatory years for nationwide competitive examination to the French schools of engineering.

2015 **Baccalauréat scientifique, Lycée Jeanne d'Arc, Clermont-Fd.** With very high honours.

Research Publications

Conference Proceedings

1. V. Souveton and S. Terrana, "Hamiltonian normalizing flows as kinetic pde solvers: Application to the 1d vlasov-poisson equations," in *Proceedings of the 2nd ECAI Workshop on "Machine Learning Meets Differential Equations: From Theory to Applications"*, C. Coelho, B. Zimmering, M. F. P. Costa, L. L. Ferrás, and O. Niggemann, Eds., ser. Proceedings of Machine Learning Research, vol. 277, PMLR, 26 Oct 2025, pp. 133–146. URL: https://proceedings.mlr.press/v277/souveton25a.html.
2. S. Terrana, P. Sochala, R. Leconte, and V. Souveton, "Blast-terrain interactions : Fast-running predictions and statistical analysis," in *Proceedings of the 27th International Symposium on Military Aspects of Blast and Shock*, Oct. 2025.
3. V. Souveton, A. Guillin, J. Jasche, G. Lavaux, and M. Michel, "Fixed-kinetic neural Hamiltonian flows for enhanced interpretability and reduced complexity," in *Proceedings of The 27th International Conference on Artificial Intelligence and Statistics*, S. Dasgupta, S. Mandt, and Y. Li, Eds., ser. Proceedings of Machine Learning Research, vol. 238, PMLR, Feb. 2024, pp. 3178–3186. URL: https://proceedings.mlr.press/v238/souveton24a.html.

PhD thesis

1. V. Souveton, "Non-reversible and generative sampling algorithms. Application to the inference of cosmological parameters," Theses, Université Clermont Auvergne, Sep. 2024. URL: https://theses.hal.science/tel-04779691.

Talks, Posters

11/05/2025 *Introduction to Transformers.* Oral presentation at a PhD and postdoctoral resaerchers' seminar at CEA (Paris, France).

10/26/2025 *Hamiltonian normalizing flows as kinetic equations solvers.* Poster and talk at the ECAI's workshop "Machine Learning Meets Differential Equation" (Bologna, Italy).

05/03/2024 *Fixed-kinetic NHF for enhanced interpretability and reduced complexity.* Poster presentation at AISTATS conference (Valencia, Spain).

Talks, Posters (continued)

04/11/2024 — *Sampling algorithms for cosmology.* Seminar presentation at CEA (Paris, France).

11/28/2023 — *Sampling with Neural Hamiltonian Flows.* Flashtalk at Institut d'Astrophysique de Paris during the "Debating the potential of Machine Learning in astronomical surveys" conference (Paris, France).

11/22/2023 — *Introduction to Geometric Deep Learning.* Presented at the PhD students seminar in Laboratoire de Mathématiques Blaise Pascal (Clermont-Ferrand, France).

09/20/2023 — *Sampling with Neural Hamiltonian Flows.* Talk during the workshop "Probabilistic sampling for physics: finding needles in a field of high-dimensional haystacks" at Institut Pascal (Orsay, France).

12/15/2022 — *Sampling with Hamiltonian Normalizing Flows.* Presented at the Simatlab seminar as part of a scientific collaboration between Université Clermont Auvergne and Michelin (Cébazat, France).

11/25/2021 — *Inferring the initial conditions of the Universe.* Presented at the Cosmology group seminar at the Oskar Klein Center (Stockholm, Sweden).

Scientific communication

01/01/2025-present — *Le Dernier Blog avant la fin du monde.* I write blog posts about scientific topics that matter to me on my personal website : `https://vincentsouveton.github.io/blog.html`

04/25/2024 — *"Moteur de recherche", émission 29.* Participation in a Radio Campus program to discuss my PhD research topics (Clermont-Ferrand, France).

11/07/2023 — *Algorithms for inferring the initial conditions of the Universe.* Talk as part of an interdisciplinary public colloquium called "Le Puy de la Recherche" (Clermont-Ferrand, France).

Skills

Languages — French (native speaker), English (full professional capacity) and Spanish (basis).

Coding — Python/PyTorch, Julia, LaTeX.

Web Dev — Basic knowledge of HTML and MarkDown.

Misc. — Driver's license.